lengths, with only short rubber connections between the tubes and to the pail.) A number of very interesting experiments may be conducted with this simple apparatus, and in this way a better idea of the conditions governing water circulation will be obtained.

The specific heat of water and its heat capacity are unity. The heat capacity of steam has a fractional value, but in contact with water, under the conditions existing in a boiler tube, it has reached the limits of its heat-absorbing capacity for the existing temperature; that is, any additional heat imparted to the steam in the tube will be immediately absorbed by the vaporization of a corresponding amount of the water present. When the water is converted into steam its volume increases from 110 to 1600 times and it displaces from 109 to 1599 additional volumes of water.

The 4-in or 100-mm boiler tube has a sectional area of 78 cm^2 54 (12.56 sq in). Its length is about 5 m 50 (18 ft) and its heating surface 1 m^2 **73** (18.6 sq ft). When a boiler is driven at 200 per cent rating it is evaporating water at the average rate of 8.1 grams per square meter per second. On this basis each tube will evap-orate 14 grams of water per second on the average. However, it is not unreasonable to

suppose that the lower tubes, directly exposed to the hot gases and radiant heat from the fuel, will have an evaporation rate of, say, ten times the average, or 140 grams of water per tube per second. At a steam temperature of 200° C. this would give a volume of 15,400 cm^3 of steam per second. The internal volume of the boiler tube is 43,200 cm^3. This would mean that about 35 per cent of the internal volume of the tube was occupied by steam. At lower steam temperatures the volume of the steam released will be much greater and fill a larger per-centage of the tube volume. It is probable that the lower end of the tube will be occupied by solid water, and if this is the case and the steam is generated uniformly the full length of the tube, 70 per cent of the area of the highest end, will be occupied by steam. Assuming that the pitch of the tube is 30 per cent, this is sufficient to give a head that will impress a velocity of 5 m 69 per second on the steam. Friction against the water surface may be either negative or positive, depending upon their relative velocities. Friction against the tube surface will reduce the steam velocity.

The steam in the upper section of the tube will not be able to absorb heat as rapidly as the water in the lower section, but as